



159159

WO 01/97339

- 1 -

PCT/EP01/06134

Distribution connection module for telecommunications and data technology

5 The invention relates to a distribution connection module for telecommunications and data technology, comprising a housing in which input and output contacts for the connection of cables or wires are arranged such that they are externally accessible, and to a method for producing the distribution
10 connection modules.

Such a distribution connection module is known, for example, from DE 27 25 551. The distribution connection module comprises a first row of connecting contacts on the cable side and, opposite this, a second
15 row of connecting contacts on the jumper side, in which case the contacts on the cable side may be regarded as input contacts, and the contacts on the jumper side may be regarded as output contacts, even when the information flow may be in the opposite direction.
20 Center contacts, into which test or protection connectors can be inserted, are arranged between the rows. Three-point or five-point overvoltage protection modules or coordinated protection circuits represent one example of such protection connectors. If such an
25 overvoltage protection device is now inserted into the center contacts, then this center tap and, in some cases, adjacent center taps as well, is no longer accessible for inspection and test purposes, or the overvoltage protection device must be removed again for
30 test and inspection purposes, so that the contacts are not protected during this time.

Furthermore, distribution connection modules are known, for example, from DE 39 17 270, in which functional elements such as coordinated protection
35 circuits can be inserted into the distribution connection module at the sides or from underneath. A disadvantage in this case is that the distribution



G00002

connection modules have to be manufactured in a correspondingly complex manner.

A common feature of all distribution connection modules is that the external functional elements must be plugged into sprung contacts, which need to be subject to stringent requirements with regard to the withstand voltage and current carrying capacity. A further disadvantage is that the external functional elements cause interference in compact, modular designs.

The invention is thus based on the technical problem of providing a distribution module for telecommunications and data technology, by means of which simpler and more compact construction is possible. A further technical problem is to provide a production method.

The technical problem is solved by the subject matters of the features in patent claims 1 and 17. Further advantageous refinements of the invention are evident from the dependent claims.

For this purpose, the housing of the distribution connection module is designed with a cavity in which functional elements are arranged between the input and output contacts. This results in the capability for very compact construction. In this case, in principle, the housing may be formed in one or more parts.

In one preferred embodiment, the functional elements are arranged on a printed circuit board which is supported in the housing. For this purpose, the housing is preferably designed in a number of parts, so that the printed circuit board can be pushed into a first housing part, and can then be locked in place by means of a second housing part. Depending on the application, differently populated printed circuit boards can thus be used, and defective printed circuit boards replaced, very easily.

The input contacts are preferably in the form of insulation-displacement contacts, so that the wires

and cables on the cable side can be connected quickly, reliably and flexibly using known techniques. Depending on the application, the output contacts are preferably likewise in the form of insulation-displacement contacts or plug connectors. The advantage of plug connectors is that, if prefabricated cables are available, the wiring process can be carried out very quickly and reliably simply by plug insertion. In situations where there are no prefabricated cables, the advantages of insulation-displacement contacts are applicable, on the other hand.

In a further preferred embodiment, the insulation-displacement contacts are each in the form of a contact in the form of a fork, by means of which a force-fitting electrical connection to the functional elements can be produced. If the functional elements are arranged on a printed circuit board, then contact pads are arranged on the printed circuit board, preferably on both sides, on the top and bottom. These force-fitting connections are considerable more tolerant to manufacturing and assembly tolerances than soldered joints. In this way, all the insulation-displacement contacts can be made contact with simultaneously by latching the contacts in the form of forks onto the contact pads. Furthermore, this method of making contact allows simple disassembly if, for example, a defective printed circuit board needs to be replaced.

Functional elements may be filter circuits, signaling devices or test circuits. In one preferred embodiment, the functional element is an overvoltage protection module, in particular a coordinated protection device. This results in integrated overvoltage protection which neither prevents subsequent jumpering, inspection or testing nor causes interference when module groups are assembled.

In a further preferred embodiment, each input and output contact has an associated isolating contact, which is externally accessible. The isolating contact

is in each case arranged in series behind the functional elements. If the functional elements are in the form of overvoltage protection, the isolating contact is fully protected.

5 If the functional elements are arranged on a printed circuit board, the isolating contacts are preferably arranged on the underneath of the printed circuit board, with the isolating contacts preferably being accessible from the same side as the input
10 contacts.

 In a further preferred embodiment, the output contacts are arranged on the opposite side of the housing to the input contacts. This achieves clear separation between the cable side and the jumpering
15 side, in which case there is no interference between the individual wires and cables.

 If the input and/or output contacts are in the form of insulation-displacement contacts, then they are dimensioned with respect to one another in such a way
20 that the existing standard connecting tools can be used. This saves the development of new and costly connecting tools, and simplifies the handling of the new distribution connection module in conjunction with already existing distribution connection modules.

25 In a further preferred embodiment, the ground lines on the printed circuit board are formed by a contact which is in the form of a ring or fork and is externally accessible. To this end, ground lines are preferably joined together on the printed circuit
30 board. The distribution connection module can then be pushed onto profiled rods using appropriate holes or openings, with the profiled rods then being connected to the contact which is in the form of a ring or fork.

 In a further preferred embodiment, the ground
35 lines are designed to be accessible from the input contact side. This optionally allows the distribution connection module to be used as an AB or ABS module, with the shields being connected to the ground lines.

In order to produce the distribution connection module according to the invention, the printed circuit board, with the functional elements, is pushed into a first housing part, and a second housing part, which is fitted with the input contacts, is latched onto it. The advantage of this method is that the component placement process and the latching can easily be automated. In embodiments with isolating contacts, there are in principle various variants.

10 In a first preferred embodiment, the isolating contacts are firstly mounted on the printed circuit board, where the isolating contacts are clamped in in an appropriate manner. The printed circuit board is then pushed, with the clamped-in isolating contacts, 15 into the first housing part, which is then latched to the second housing part. In consequence, no furnishings are required on the housing to adversely affect its robustness.

In an alternative embodiment, the printed circuit board is first of all pushed into the first housing part, and the isolating contacts are then attached to the printed circuit board and clamped in from the underneath of the housing. This makes it possible to retrofit the distribution connection 25 modules with isolating contacts very easily.

The invention will be explained in more detail in the following text with reference to a preferred exemplary embodiment. In the figures:

- Figure 1 shows a cross section through a distribution connection module,
- 30 Figure 2 shows a front view of a distribution connection module,
- Figure 3 shows a schematic circuit arrangement of a distribution connection module with coordinated protection,
- 35 Figure 4 shows a schematic method sequence for producing a distribution connection module,

Figure 5 shows a schematic method sequence for an alternative method for producing a distribution connection module,

5 Figure 6 shows a block diagram of a distribution connection module having an ADSL splitter, and

Figure 7 shows an exploded illustration of a distribution connection module.

10 Figure 1 shows a cross section of the distribution connection module 1 with a test connector 2 inserted. The distribution connection module 1 comprises a housing 3, input contacts 4, output contacts 5 and a printed circuit board 6 arranged in the cavity in the housing 3. The input contacts 4 are
15 in the form of insulation-displacing contacts for making contact with wires 7 which are accessible from a first end face 8 of the housing 3. On the side facing the printed circuit board 6, the input contacts 4 are formed with contacts 9 in the form of forks. The
20 contacts 9 in the form of forks engage around the printed circuit board 6 and form a force-fitting connection to contact pads arranged on the top and bottom of the printed circuit board 6. Coordinated protection circuits are arranged on the printed circuit
25 board 6, and are located between the input contacts 4 and the output contacts 5. In this case, each coordinated protection device has two associated input contacts 4 and two associated output contacts 5. The coordinated protection device comprises a surge
30 arrester 11, two PTC thermistors 12 and two diodes 13, whose ground lines are connected via a contact 14, in the form of a ring or fork, to a profiled rod 15 which passes through the housing 3. Located behind the coordination protection device is the isolating contact
35 10, which is arranged on the underneath of the printed circuit board 6, with the printed circuit board 6 being plated through, for example close to the diodes 13, for electrical connection of the coordinated protection device and the isolating contact 10. The isolating

contact 10 is located on a support 16 which is fixed in the housing 3. The isolating contact is prestressed in a sprung manner via a clamping device 17, so that the bent contacts 18, 19 make contact with the printed circuit board 6. Behind the contact 19 there is an electrical connection to the output contacts 5, which are connected to the printed circuit board 6 via a soldered, press or plug connection 20. Thus, without a test connector 2, the input contacts 4 are connected via the coordinated protection device and the downstream isolating contact 10 to the output contacts 5. For test purposes, a test connector 2 with a board 27 can then be pushed into the housing 3 from the end face 8. In consequence, we [sic] the contact 19 of the isolating contact 10 pushed away from the printed circuit board 6, as shown, and the electrical connection between the input and output contacts 4, 5 is disconnected or is made via the test connector 2. Since the isolating contact 10 is arranged behind the coordinated protection device, the isolating contact 10 remains fully protected against overvoltage even during test activities using the test connector 2. Since large forces can occur when connecting the insulation-displacement contacts, a holding or supporting element in the form of plastic can also be latched onto the printed circuit board 6 in the area of the contacts 9 in the form of forks and over the full width of the printed circuit board 6, thus fixing the contacts 9 in the form of forks on the printed circuit board 6.

Figure 2 shows a front view of the end face 8 of the distribution connection module 1. The distribution connection module 1 has 16 input contacts 4 which are combined in pairs and are used, for example, for connecting pairs of wires. An access for a test connector 21 is arranged under each pair of input contacts 4. The isolating contacts are externally accessible via this access 23. In this case, the two isolating contacts of the two input contacts 4 are operated at the same time by inserting a test connector

21 into the access 23. The housing 3 also has cable guides 24 and strain-relief devices 25.

Figure 3 shows, schematically, the circuit arrangement for a distribution connection module having coordinated protection devices as functional elements. The circuit has 16 input contacts a1, b1 - a8, b8 and 16 output contacts a1', b1' - a8', b8', with each a, b pair being used to connect a pair of wires. The input and output contacts a, b and a', b', respectively, in this case correspond to the input and output contacts 4, 5 in Figure 1. In this case, two input contacts in each case have an associated coordinated protection device. As already described in Figure 1, each coordinated protection device comprises a three-pole surge arrester 11, two PTC thermistors 12 and two diodes 13. Each surge arrester 11 has an associated fail-safe contact 26 with at least one fuse element, which permanently shorts the two input contacts to ground when an overvoltage occurs. The two isolating contacts 10 are arranged between the coordinated protection device and the two associated output contacts.

Figure 4 shows, schematically, a production method for a distribution connection module 1 as shown in Figure 1. In a first method step A, the isolating contacts 10 with their clamping devices 17 are mounted on a common support or separate support 16 on the underneath of the printed circuit board 6. Then, in a method step B, the fully populated printed circuit board 6 is pushed into the cavity of a first housing part 21. Then, in a further method step C, a second housing part 22, in which the input contacts 4 are arranged, is latched onto the first housing part 21.

Figure 5, shows schematically, an alternative production method. In this case, the fully populated printed circuit board 6 is first of all pushed into the first housing part 21 in a first method step A and then, in a method step B, the isolating contacts 10 are inserted from the underneath of the first housing part

21. The second housing part 22 is then once again latched onto the first housing part 21, in the method step C.

Figure 6 shows a block diagram of a distribution connection module 1 having an ADSL splitter as a functional group, in which case ADSL represents an Asymmetric Digital Subscriber Line. ADSL is a transmission technology for providing broadband data terminations via the conventional copper-cable access network. ADSL systems are, without exception, designed as bi-directional transmission systems using both traffic directions (downstream and upstream). The downstream channel, in the direction of the user, is designed to be broadband while, in contrast, the upstream channel in the opposite direction has a relatively narrow bandwidth and is intended primarily for transmitting control messages. Application examples for ADSL include, in particular, video on demand and multimedia Internet applications. The distribution connection module 1 has input contacts 4, output contacts 5 and test accesses 28. Furthermore, the distribution connection module 1 has at least one printed circuit board 6 on which overvoltage protection 29, a low-pass filter 30 and an isolating capacitor 31 are arranged. The ADSL splitter is formed by the low-pass filter 30 and the isolating capacitor 31 and isolates the radio-frequency ADSL signal, which is produced at the right-hand output 5, from a low-frequency POTS or ISDN signal, which is produced at the left-hand output 5 while, in contrast, the input 4 represents the subscriber access. For clarification, it should be noted that, due to the bi-directional transmission, signals are transmitted from the input 4 to the output 5 and vice versa, so that the terms "input" and "output" relate to the different information-technology connection sides of the distribution connection module. The isolating capacitor 31 is used to isolate the DC operating voltage from the ADSL port. In applications where this function is

already provided in the DSLAM (Digital Subscriber Line Access Multiplexer), the isolating capacitor 31 can be omitted. The filter characteristic of the low-pass filter 30 is preferably matched to the ADSL systems
5 used in DTAG, which use only the 138 kHz frequency band, and are thus also ISDN-compatible. In principle, other configurations with special optimization to individual services are feasible. The optional overvoltage protection 29 is used for protection
10 against transient overvoltages, and improves the capability of the assembly to withstand voltages resulting from pulsed interference at, for example, 4 kV. The test accesses 28, which are preferably in the form of plug connectors, in particular SUB-D plug
15 connectors, are used in order to permanently feed the signal on the subscriber line to an external switching device and test set, and back again. The splitter can be operated without this external loop by inserting an appropriate short-circuiting connector. The main type
20 of operation for the ADSL splitter is as the main distribution module.

Figure 7 shows an exploded illustration of the distribution connection module 1 shown in Figure 6. The distribution connection module 1 has a first housing
25 part 21 and a second housing part 22. The second housing part 22 has a row of input contacts 4 and output contacts 5, which are each in the form of insulation-displacement contacts. The input contacts 4 and the output contacts 5 are each arranged in
30 connection strips, whose housing upper parts 32 and 33, respectively, are latched on via the insulation-displacement contacts. The housing upper parts 32, 33 are each formed with latching elements 34, which engage in corresponding latching grooves 35 in the housing
35 lower parts 36, 37 of the connection strips. The connection strip is preferably in the form of an ABS strip, so that a shield which is associated with the double conductors can also be connected, thus improving the crosstalk attenuation between the subscriber lines

on which the ADSL signal is carried. The output contacts 5 form the ports for the POTS/ISDN lines. The second housing part 22 also has latching means 38, which correspond with corresponding latching grooves 39 in the first housing part 21. Two printed circuit boards 6 are arranged in the first housing part 21 and are electrically connected to the input contacts 4 and output contacts 5. The test accesses 28 and the other output contacts 5 for the ADSL port are arranged on the rear face of the first housing part 21, and are preferably each in the form of SUB-D plug connectors. On the side walls, the first housing part 21 is formed with cable bushings 24 and two annular contacts 14, via which the ground lines of the printed circuit board 6 are connected to a profiled rod which is used as a ground rail.

List of reference symbols

- 1) Distribution connection module
- 2) Test connector
- 3) Housing
- 4) Input contact
- 5) Output contact
- 6) Printed circuit board
- 7) Wires
- 8) End face
- 9) Contact in the form of a fork
- 10) Isolating contact
- 11) Surge arrester
- 12) PTC thermistor
- 13) Diode
- 14) Contact in the form of a ring
- 15) Profiled rod
- 16) Support
- 17) Clamping device
- 18) Bent contact
- 19) Bent contact
- 20) Plug connection
- 21) Board
- 21) First housing part
- 22) Second housing part
- 23) Access
- 24) Cable guide
- 25) Strain relief
- 26) Fail-safe contact
- 27) Board
- 28) Test access
- 29) Overvoltage protection
- 30) Low-pass filter
- 31) Isolating capacitor
- 32, 33) Housing upper part
- 34) Latching element
- 35) Latching groove
- 36, 37) Housing lower part

- 38) Latching means
- 39) Latching groove

**Distribution connection module for telecommunications
and data technology**

Patent Claims:

5

1. A distribution connection module for telecommunications and data technology, comprising a housing in which input and output contacts for the connection of cables or wires are arranged such that they are externally accessible,

10

wherein

the housing (3) is designed with a cavity in which functional elements are arranged between the input and output contacts (4, 5).

15

2. The distribution connection module as claimed in claim 1, wherein the functional elements are arranged on at least one printed circuit board (6), which is supported in the housing (3).

20

3. The distribution connection module as claimed in claim 1 or 2, wherein the input contacts (4) are in the form of insulation-displacement contacts, or comprise insulation displacement contacts.

25

4. The distribution connection module as claimed in one of the preceding claims, wherein the output contacts (5) are in the form of insulation-displacement contacts or electrical plug connectors.

30

5. The distribution connection module as claimed in claim 3 or 4, wherein the insulation-displacement contacts are each formed with a contact (9) in the form of a fork, by means of which a force-fitting electrical connection can be produced to the functional elements.

35

6. The distribution connection module as claimed in one of the preceding claims, wherein the functional elements are in the form of overvoltage protection, in particular a coordinated protection circuit.

7. The distribution connection module as claimed in one of the preceding claims, wherein an isolating contact (10) which is externally accessible is in each

case arranged between an input and output contact (4, 5).

8. The distribution connection module as claimed in claim 7, wherein the isolating contact (10) is
5 arranged in series with the functional elements.

9. The distribution connection module as claimed in claim 8, wherein the isolating contact (10) is arranged behind the functional elements.

10. The distribution connection module as claimed
10 in one of claims 7 to 9, wherein the isolating contact (10) is arranged on the underneath of the printed circuit board (6).

11. The distribution connection module as claimed in claim 10, wherein the isolating contact (10) is
15 accessible from the side of the input contacts (4).

12. The distribution connection module as claimed in one of the preceding claims, wherein the input contacts (4) and output contacts (5) are arranged on opposite end faces of the housing (3).

20 13. The distribution connection module as claimed in one of claims 3 to 12, wherein the distances between the insulation-displacement contact elements are dimensioned with respect to one another in such a way that the wires (7) can be connected using standard
25 connecting tools.

14. The distribution connection module as claimed in one of claims 2 to 13, wherein the ground lines on the printed circuit board (6) are designed such that they are externally accessible by means of at least one
30 contact (14) in the form of a ring or fork.

15. The distribution connection module as claimed in claim 14, wherein the housing (3) is designed with snap-action elements in the area of the contact (14) which is in the form of a fork, via which snap-action
35 elements the distribution connection module (1) can be latched onto the profiled rod (15).

16. The distribution connection module as claimed in one of claims 2 to 15, wherein the ground lines on the printed circuit board (6) are routed to the end

face (8) on which the input contacts (4) are fitted, and are designed to be externally accessible.

17. A method for producing a distribution connection module as claimed in claim 2, by means of a two-part housing, comprising the following method steps:

a) insertion of the printed circuit board into a first housing part (21) and

b) latching a second housing part (22), to which the input contacts (4) are fitted, to the first housing part (21).

18. The method as claimed in claim 17 for producing a distribution connection module as claimed in claim 7, wherein the isolating contacts (10) are mounted on the fully populated printed circuit board (6) before the latter is pushed into the first housing part (21).

19. The method as claimed in claim 17 for producing a distribution connection module as claimed in claim 7, comprising the following method steps:

a) inserting the fully populated printed circuit board (6) into the first housing part (21),

b) pushing in the isolating contacts (10) from the underneath of the first housing part (21), so that the isolating contacts (10) are clamped in on the printed circuit board (6), and

c) latching the second housing part (22), which is fitted with the input contacts (4), onto the first housing part (21).

20. The method as claimed in claim 17 for producing a distribution connection module as claimed in claim 7, comprising the following method steps:

a) inserting the fully populated printed circuit board (6) into the first housing part (21),

b) latching the second housing part (22), which is fitted with the input contacts (4), onto the first housing part (21) and

c) pushing in the isolating contacts (10) from the underneath of the first housing part (21), so that the

isolating contacts (10) are clamped in on the printed circuit board (6).